

***Athanas anadactylus* sp. nov., a New Alpheid Shrimp (Crustacea: Decapoda) Associated with Crinoids in the Tropical Western Pacific**

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Arthur Anker and Ivan N. Marin (2007) *Athanas anadactylus* sp. nov., a new alpheid shrimp (Crustacea: Decapoda) associated with crinoids in the tropical western Pacific. *Zoological Studies* 46(2): 162-167. *Athanas anadactylus* sp. nov. is described on the basis of a holotype specimen collected in Nhatrang Bay, Vietnam, and an additional specimen from the Bohol Sea, the Philippines. The specimen from Nhatrang Bay was collected from a crinoid host. The new species is unique within the genus *Athanas* in having non-enlarged, symmetrical chelipeds ending in a peculiar claw with duckbill-shaped fingers, and the 3rd maxilliped having a broadened ultimate segment, distally armed with a row of strong spines. It is closely related to *A. ornithorhynchus* Banner and Banner, 1973, known as a facultative symbiont of filter-feeding brittle stars. An earlier report of a crinoid-associated *Athanas* (Bruce 1987) suggests that *A. anadactylus* sp. nov. may also occur on the Great Barrier Reef, Australia. <http://zoolstud.sinica.edu.tw/Journals/46.2/162.pdf>

Key words: Alpheidae, Shrimp, *Athanas*, Crinoid, Symbiosis.

The alpheid shrimp genus *Athanas* Leach, 1814 presently includes about 30 species, the majority of which are concentrated in shallow waters of the tropical Indo-West Pacific (e.g., Banner and Banner 1973, Chace 1988). *Athanas* species can be recognized by the small size (not exceeding 1 cm in length); the presence of a long, acute rostrum and orbital (extra-corneal, sometimes also infra- and supra-corneal) teeth; the more-or-less enlarged chelipeds, carried either folded or extended, with chelae lacking a fossa-tooth system on the fingers; the presence of a subtriangular posteroventral flap on the 6th abdominal somite; the absence of an arthrobranch on the 3rd maxilliped; and the presence of strap-like epipods on the coxae of the 3rd maxilliped and 1st to 3rd (very rarely 4th) pereopod (Chace 1988, Anker and Jeng, in press). Most *Athanas* are free-living, but some are associated - permanently or

facultatively - with other marine organisms, such as corals, sponges, clams, hermit crabs, thalassinideans, stomatopods, fishes, sea urchins, brittle stars, and feather stars (Schmitt 1926, Crosnier and Forest 1966, Banner and Banner 1973, Bruce 1987, Frogliani and Atkinson 1998, Anker et al. 2001, Hayashi 2002, Anker 2003, Marin et al. 2005).

In a brief note published in a popular underwater magazine, Bruce (1987) provided 2 *in situ* photographs taken by Dave Phillips off Lizard I., Great Barrier Reef, showing a conspicuously red-and-white banded alpheid shrimp clinging to a crinoid, *Himerometra* sp. (Himerometridae). He tentatively identified this shrimp as *Athanas ornithorhynchus* Banner and Banner, 1973, originally described from northern and western Australia (Banner and Banner 1973). To our knowledge, Bruce's (1987) note is the 1st and only

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record of an association between a species of *Athanas* and a crinoid. More recently, Marin et al. (2005) reported an association between *A. ornithorhynchus* and a filter-feeding ophiuroid, *Macrophiothrix longipeda* (Lamarck, 1816) [It should be noted that the identity of the host needs confirmation; for the time being, it should be referred to as *Macrophiothrix* sp. aff. *longipeda* (G. Hendler, pers. comm.)]. The only other known alpheid shrimps permanently associated with filter-feeding echinoderms are several species of *Synalpheus* Bate, 1888, all symbionts of mostly comasterid crinoids (Bruce 1982).

During an ongoing study of the biodiversity of marine invertebrates of Nhatrang Bay, southern Vietnam (Marin et al. 2004 2005), our colleagues, A. Zhadan and A. Beliaev, found a single *Athanas* specimen in an unidentified reef crinoid. This specimen was remarkable in bearing 2 non-enlarged chelipeds, ending in a peculiar claw with duckbill-shaped fingers. This claw appeared to be very similar to the duckbill-shaped claw of the minor cheliped of *A. ornithorhynchus* (cf. Banner and Banner 1973, Marin et al. 2005). However, 2 features, the presence of 2 duckbill-shaped claws (instead of 1) and the broadened tip of the 3rd maxilliped bearing a row of stout spines, indicated that the crinoid-associated *Athanas* species from Nhatrang Bay was undescribed. An additional specimen of this species was collected in the Philippines during the international Panglao Marine Biodiversity Project in 2004. This specimen was collected while brushing coral rubble lifted from a depth of 15-20 m, but association with a particular host was not recorded. The new species is described and illustrated on the basis of these 2 specimens.

MATERIALS AND METHODS

All drawings were made with the help of a camera lucida. Carapace length (CL, in mm) and total body length (TL, in mm) were measured from the tip of the rostrum to the posterior margin of the carapace and telson, respectively. The holotype of the new species is deposited in the collections of the Zoological Museum of the Moscow State University, Moscow, Russia (ZMMU); an additional specimen is deposited in the collections of the Raffles Museum of Biodiversity Research, National University of Singapore, Singapore (ZRC). Abbreviations used in the text: Mxp, maxilliped; P, pereopod.

TAXONOMY

Athanas Leach, 1814

Athanas anadactylus sp. nov.

(Figs. 1, 2, 3a)

Material examined: Holotype: 1 ovigerous female (CL 3.2, TL 8.0), ZMMU Ma 5470, Vietnam, Nhatrang Bay, Tre I., depth 7 m, on unidentified crinoid, scuba, coll. A. Zhadan and A. Beliaev, 1 Oct. 2003.

Additional specimen examined: 1 ovigerous female (CL 4.0, TL 10.3), ZRC 2006.0069, Panglao Marine Biodiversity Project, the Philippines, Pamilacan I., sta. B22, depth 15-20 m, rubble on mixed bottom, 9°29.4'N, 123°56.0'E, 24 June 2004.

Description: Body subcylindrical, not compressed; carapace smooth except for scarce erect setae (Fig. 1a, c). Rostrum long, acute, reaching end of antennular peduncle (Fig. 1b), with distinct lateral ridges; mediorostral carina feebly developed, not reaching rostral base or level of eyes. Extra-corneal teeth well developed, acute, reaching distal margin of 1st segment of antennular peduncle, about 2/5 length of rostrum (Fig. 1b, c); infra-corneal and supra-corneal teeth absent. Pterygostomial angle rounded, slightly protruding anteriorly, but without acute tooth (Fig. 1c). Cardiac notch well developed. Eyes partly concealed, with only most-anterior portion visible in dorsal and lateral views; cornea well developed, occupying most of eye peduncle, well pigmented (Fig. 1b, c).

Antennular peduncle stout; stylocerite strong, acute, reaching mid-length of 3rd article of antennular peduncle; 2nd article shorter than dorsally visible portion of 1st article (Fig. 1b). Antenna with basicerite bearing strong, acute ventrolateral tooth; scaphocerite overreaching carapace and distal margin of antennular peduncle, subrectangular; anterior margin of blade evenly convex, distolateral spine strong, acute (Fig. 1b).

Mouthparts – mandible, maxillule, maxilla, 1st and 2nd maxillipeds - typical for genus; incisor process of mandible bearing 5 teeth (Fig. 2a). Third maxilliped stout, antepenultimate segment with slender subdistal spine on ventral margin (Fig. 1d); ultimate segment stout, distally conspicuously widening, tip enlarged, furnished with a row of strong spines (Fig. 1e, f); coxa with ear-shaped lateral plate, distally subacute (Fig. 1d); arthrobranch absent.

First pereopods (chelipeds) equal in size,

symmetrical in shape, not particularly enlarged (Fig. 1a, g-i), subequal to 3rd maxilliped and shorter than 2nd pereopod (Fig. 1a); basis with 1 dorsal spine; ischium with 2 dorsal spines (Fig. 1g, h); merus about 4 times as long as wide, unarmed, ventrally slightly depressed; carpus relatively short, vase-shaped, distally widening; palm smooth, sub-cylindrical; fingers duckbill-shaped, broadened,

gaping, truncate distally (Fig. 1h), with cutting edges excavated, distal margin furnished with minute teeth (Fig. 1j).

Second pereopod relatively short; basis with 1 strong dorsal spine; ischium with 3 spines on dorsal margin (Fig. 2b); carpus with 5 articles with approximate ratio (from proximal to distal) of 5: 1: 1: 0.8: 2.5 (Fig. 2b); chela simple, slender, as

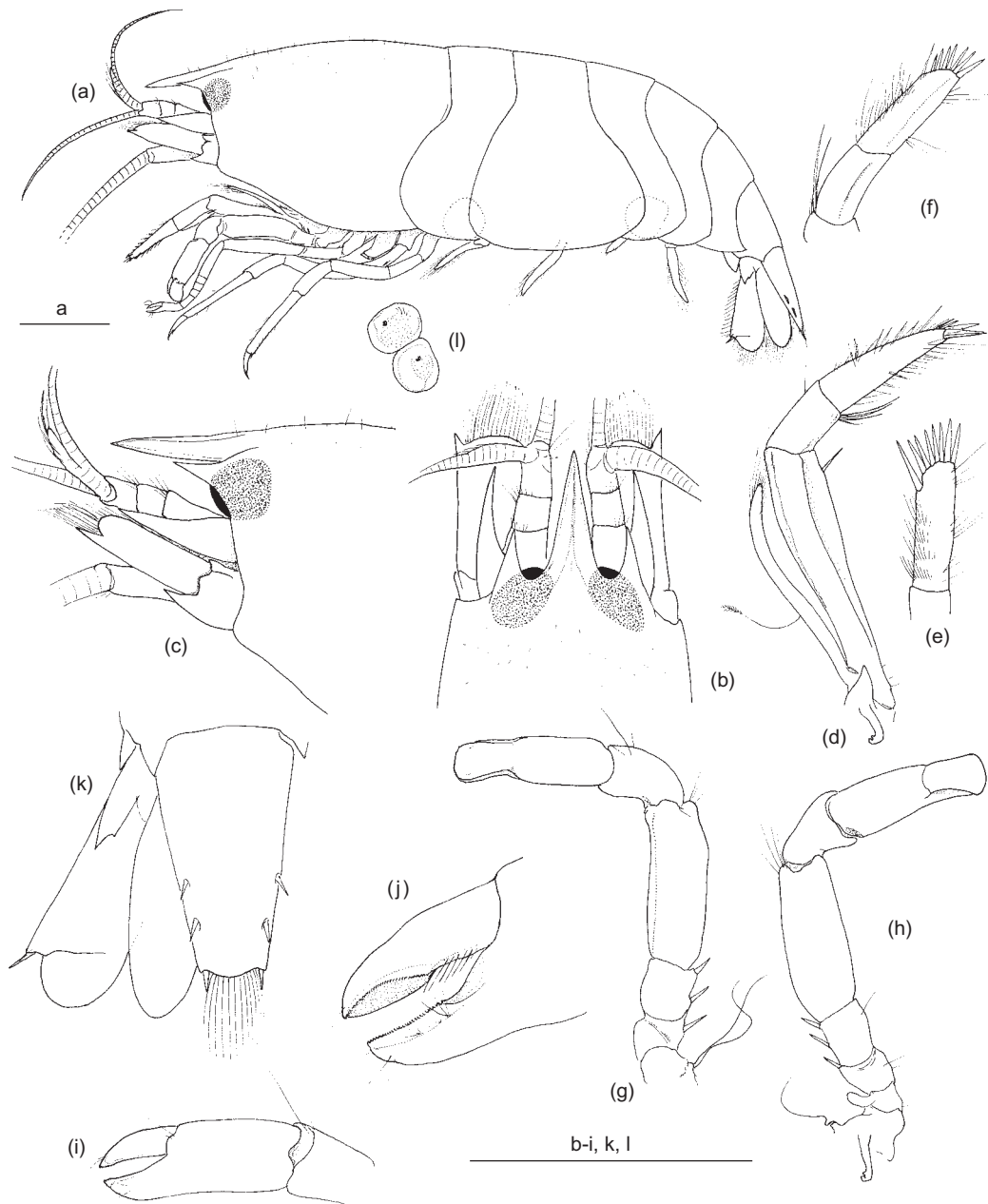


Fig. 1. *Athanas anadactylus* sp. nov., holotype, ovigerous female from Nhatrang Bay, Vietnam (ZMMU Ma 5470). (a) Habitus; (b) frontal region, dorsal view; (c) same, lateral view; (d) 3rd maxilliped, lateral view; (e) same, ultimate segment in dorsomesial view; (f) same, penultimate and ultimate segments in dorsal view; (g) right cheliped, mesial view; (h) same, lateral view; (i) same, chela; (j) same, detail of fingers; (k) telson and uropods; (l) eggs. All scales: 1 mm; figure j drawn without scale.

long as 1st carpal article, pollex and dactylus much longer than palm. Third pereopod moderately slender ischium with 1 ventrolateral spine and 3 dorsal spines (Fig. 2c); merus and carpus unarmed; propodus armed ventrally with about 6 small spines and 1 slender distoventral spine (Fig. 2c); dactylus biunguiculate, slender, distally very slightly curved, secondary unguis pronounced, situated at about 2/3 dactylar length. Fourth pereopod similar to 3rd pereopod. Fifth pereopod with unarmed ischium, merus, and carpus; propodus with 3 or 4 small spines on ventral margin, 1 distoventral spine and several (at least 5) rows of short setae ventrolaterally (Fig. 2d); dactylus biunguiculate, similar to that of 3rd pereopod.

First to 4th abdominal somites with ventrally rounded pleura, pleuron of 5th somite with acute posteroventral angle (Fig. 1a); 6th somite with articulated plate, posterolateral margin subacutely produced. Uropods with sympodite bearing 2 acute teeth (Fig. 1k); exopod with slender lateral spine; diaeresis almost straight, without specific features. Telson subrectangular, tapering distally (Fig. 1k); dorsal surface with 2 pairs of spines, both situated in posterior 1/2; posterior margin slightly rounded, with 2 posterolateral spines,

mesial spines slender, more than twice as long as lateral spines (Fig. 2e, mesial spines apparently broken in holotype, cf. Fig. 1k). Gill-exopod formula: 5 pleurobranchs (P1-5); 0 arthrobranch; 0 podobranch; 2 lobe-shaped epipods (Mxp1-2); 4 strap-like epipods (mastigobranchs) (Mxp3, P1-3); 4 sets of setobranchs (P1-4); 3 exopods (Mxp1-3), no rudimentary exopod-like structures visible on basis of P1-2.

Color: The colour pattern of the holotype from Nhatrang Bay was not noted. The colour pattern of the specimen from Pamilacan can be described as semitransparent with 7 or so deep-red transverse bands of various widths, alternating with 3 broad and 3 narrow white transverse bands; chelipeds, walking legs, tail fan, 3rd maxilliped, antennae, and antennules purplish-red (Fig. 3a).

Size: CL range 3.2-4.0 mm, TL range 8.0-10.3 mm.

Eggs: Both the holotype and the non-type specimen are ovigerous and were carrying approximately 15 and 30 eggs, respectively. The eggs of the holotype are at a more-advanced developmental stage and have eyespots (Fig. 1l). The egg dimensions are approximately 0.55 x 0.40-0.45 mm in diameter (measured on 2 eggs carried by

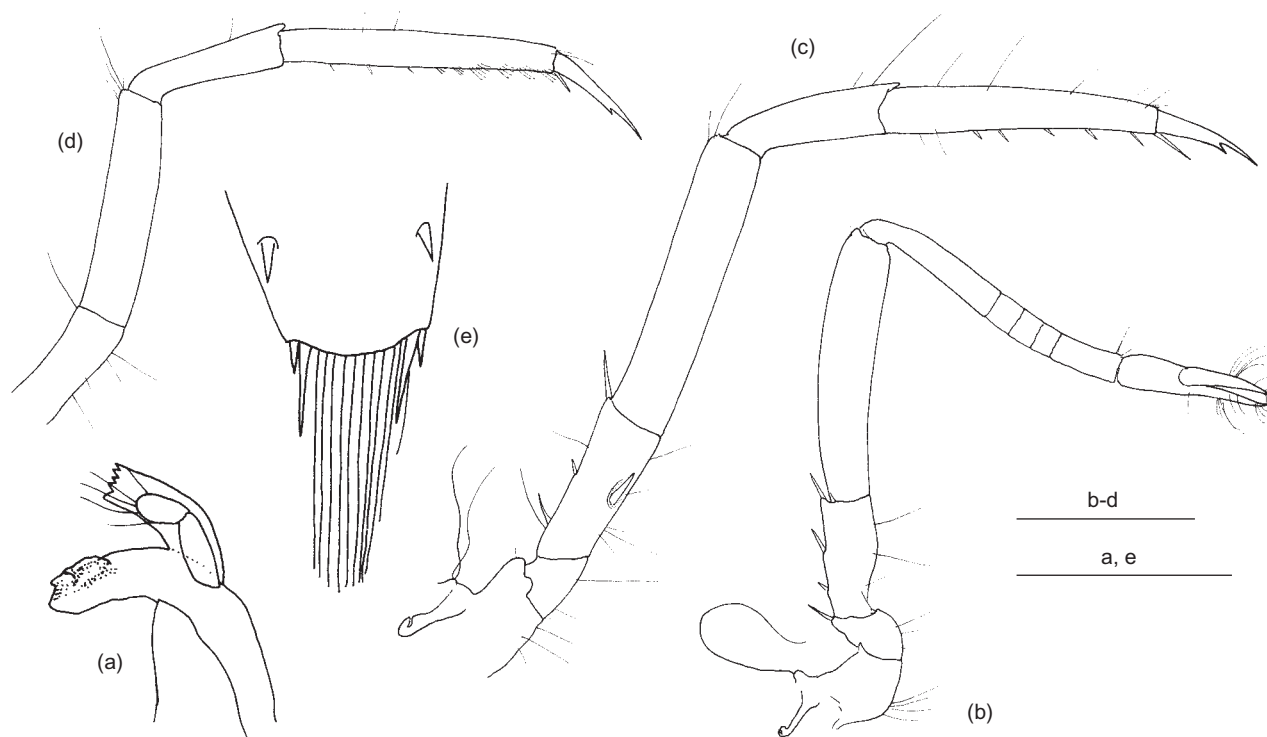


Fig. 2. *Athanas anaticdactylus* sp. nov., holotype, ovigerous female from Nhatrang, Vietnam (ZMMU Ma 5470) (a-d) and additional specimen, ovigerous female from Pamilacan, Philippines (ZRC 2006.0069) [e]. (a) Mandible, ventromesial view; (b) 2nd pereopod, lateral view; (c) 3rd pereopod, lateral view; (d) 5th pereopod, lateral view; (e) telson, posterior portion. Scales: 0.5 mm.

the specimen from Pamilacan I.).

Etymology: The new species is named for the characteristic duckbill-shaped cheliped fingers, by combining the Latin word *anas* (duck) with the Latinized version of the Greek word *dactylos* (finger).

Habitat: The holotype from Nhatrang Bay was washed from an unidentified comasterid feather star collected on a coral reef at a depth of about 7 m. The specimen from Pamilacan I. was extracted from rubble on a mixed bottom at 15-20 m.

Distribution: Western Pacific Ocean: presently known only from Nhatrang Bay, southern Vietnam (type locality), and Pamilacan I., Bohol Sea, the Philippines; possibly also Lizard I., Great Barrier Reef, Queensland, Australia (see below).

Remarks: *Athanas anaticdactylus* sp. nov. is unique within *Athanas* in having symmetrical, equal chelipeds ending in duckbill-shaped fingers; and the distally broadened ultimate segment of the 3rd maxilliped, which is furthermore armed with a row of strong apical spines. The new species shares many features with *A. ornithorhynchus*,

such as the shape of the rostrum and orbital teeth, the biunguiculate dactylus on the 3rd to 5th pereopods, the presence of at least 1 chela with duckbill-shaped fingers, and the colour pattern consisting of broad red-and-white transverse bands (Fig. 3a, b, see also Marin et al. 2005). However, in *A. ornithorhynchus*, the duck (or platypus) bill-shaped chela is present only on the minor cheliped, the major cheliped being much more robust and elongated, ending in an enlarged chela fairly typical of that of species of the *A. dimorphus* Ortmann, 1894 species group (Banner and Banner 1973, Hayashi 1995, Marin et al. 2005). The diagnostic chelipeds and the 3rd maxilliped immediately separate *A. anaticdactylus* sp. nov. from all other species of the genus *Athanas*.

Bruce's (1987) tentative record of *A. ornithorhynchus* from Lizard I., Great Barrier Reef requires confirmation. The photographs of the *Athanas* sp. with purplish-red and white bands clinging to a black-and-yellow crinoid, *Himerometra* sp. (Fig. 3c, d), cannot be positively identified without the specimen, which was not collected (Bruce 1987). However, since the holotype of *A. anaticdactylus* sp. nov. was also found on a crinoid, it is more likely that the shrimp on these photographs is actually *A. anaticdactylus* sp. nov. and not *A. ornithorhynchus*. This is also supported by slight differences in the colour pattern: for instance, the red bands appear to be broader in *A. anaticdactylus* sp. nov. compared to *A. ornithorhynchus* (Fig. 3a, b; see also Marin et al. 2005).

In summary, *A. anaticdactylus* sp. nov. and *A. ornithorhynchus* are 2 closely related *Athanas* species characterized by the presence of a duck-billed-shaped claw and the conspicuous colour pattern consisting of transverse red-and-white bands. They are associated - presumably facultatively - with filter-feeding echinoderms: *A. anaticdactylus* sp. nov. with feather stars (present study), and *A. ornithorhynchus* with spiny brittle stars (Marin et al. 2005). The distal broadened end of the claw fingers is furnished with what appears to be tiny teeth or spinules, which might be used for scraping off food particles. A more-detailed study of the finger tips (using scanning electron microscopy), observations of behaviour in the aquarium, and analysis of stomach contents could perhaps shed more light on the trophic relationships of both *Athanas* species with their hosts.

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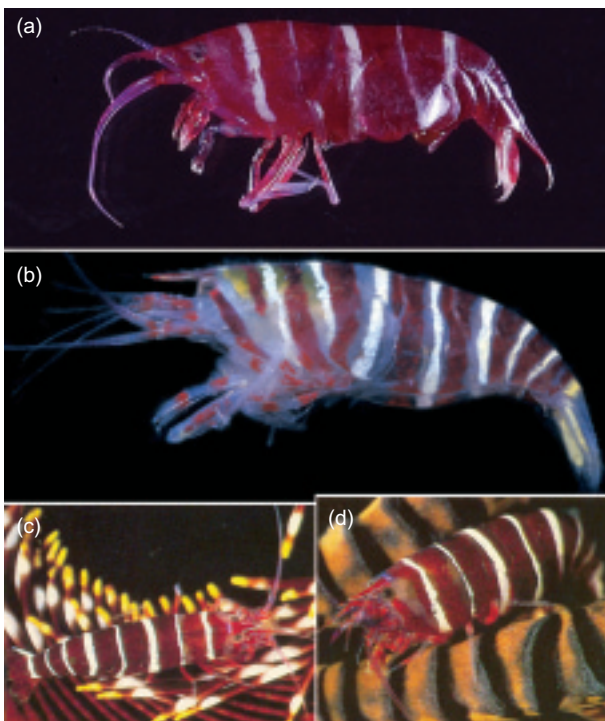


Fig. 3. Red-and-white banded species of *Athanas*. (a) *Athanas anaticdactylus* sp. nov., ovigerous female from Pamilacan, Philippines (ZRC 2006.0069); (b) *Athanas ornithorhynchus* Banner and Banner, 1973, female from Nhatrang Bay, Vietnam (ZMMU Ma 5470); (c, d) *Athanas* cf. *anaticdactylus* sp. nov. on the crinoid host, *Himerometra* sp. (Photographs by Tin-Yam Chan (a), Oleg Savinkin (b), David Philips (c, d).)

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